REMARKS

Claims 1 and 4-24 remain pending in the present application. Claims 1 and 14 are amended to address the formal rejections in the outstanding Office Action, issued 18 January 2007. Claim 12 is amended to include a more preferred pore size for the barrier layer, for which basis is provided at page 17, lines 29-32 of the specification. No new matter is added.

Applicant would like to thank the Examiner for the courtesy extended in the personal interview conducted on 6 March 2007 with Applicant and his representative. During the interview, Applicant discussed information relating to the claims and their distinctions over the cited references. In particular, Applicant discussed that the values of Frazier air permeability and hydrostatic head, as expressed in claims 1 and 14 are dependent upon multiple factors, and not merely upon fiber diameter and the polymer which the fibers are made. A more thorough discussion follows below.

Rejections under 35 U.S.C. §112

Claims 1, 4-14, 16, 23 and 24 stand rejected under 35 U.S.C. §112, first paragraph for failing to comply with both the written description and enablement requirements of the statute. Applicant traverses this basis for rejection, in view of the amendment of claims 1 and 14 to remove the word "continuous", objected to by the Examiner. Withdrawal of the rejection is requested on this basis.

Rejection under 35 U.S.C. §102(e)/103(a) over Zucker

Claims 1, 4, 7-9, 13, 14, and 16 stand rejected under 35 U.S.C. §102(e)/103(a) as anticipated by or obvious over Zucker (U.S. Published Application No. 2003/0129909). Applicant traverses this basis for rejection and respectfully requests reconsideration and withdrawal thereof.

Applicant reiterates his remarks in traverse of the enablement of Zucker, presumably now abandoned, as set forth in detail in Applicant's prior response.

The present invention

Each independent claim of the present application (claims 1 and 14) requires the nonwoven fabric to have a novel combination of liquid barrier (hydrostatic head) and air permeability (Frazier permeability) properties; i.e. hydroheads between about 145 cm and about 400 cm, and Frazier permeabilities between about 0.3 m^3/m^2-min and about 11.2 m^3/m^2-min. This balance of improved properties is particularly important and advantageous for garments to be worn for long terms by workers involved in environmental cleanup, operating rooms and the like.

In the present specification, prior art garments having the highest liquid barrier properties are disclosed to have the lowest air flow permeabilities, and vice versa (page 3, lines 1-6; page 6, lines 11-19 and Fig. 1). As seen in Fig. 1, the properties of Frazier (air permeability) and hydrohead are generally known in the art to be inversely proportional, i.e. the higher the air permeability, the lower the hydrohead, and vice versa.

According to the present invention, Applicant has discovered a way to greatly increase hydrohead while preserving adequate air permeability of fabrics by combining a number of factors, including (1) the fabric (polymer) composition, (2) fiber size, (3) basis weight of the barrier layer, (4) nature of the supporting substrate and (5) post-processing steps, such as calendering to obtain particular fabric solids fractions. Applicant submits herewith a modified version of Fig. 1, which indicates the limits of Frazier and hydrohead set forth in the present independent claims (cross-hatched area). As is clear from the modified graph, the presently claimed range is well outside the capabilities of the known prior art at the time of filing of the present invention.

Hydrohead

In the specification at page 8, Applicant begins to discuss the factors of nonwoven fabrics which contribute to hydrohead (pore size, which is related to fiber size and void fraction) and Frazier (related to fiber size, void fraction and basis weight). Factors affecting pore size are discussed in Equations (3) and (4), which indicate that the maximum pore size D_p is proportional to the fiber diameter D_f divided by the solids volume fraction c. When combined with Equation (2) (page 7), a relationship describing how to evaluate hydrohead (ΔP) is reached (Equation 5; page 9).

Frazier

Continuing on page 9, Applicant develops equations defining the parameters affecting air flow through a nonwoven fabric. Equation (8) reveals that the thickness of the fibrous medium is proportional to the basis weight/ (fiber density x solids fraction), and Applicant arrives at Equation (10), which relates Frazier to hydrohead, basis weight and solids fraction by combining Equations (5) and (9), expressing the variables in specific units (page 10, lines 1-13).

Additional correction factors are discussed at page 10, line 14 through page 11, line 17, after which Applicant concludes:

> The present inventor has determined that the model for hydrohead, Equation 5, and the model for flow, Equation 14, can be used together to define the requirements for functionally superior liquid barrier fabrics (page 11, lines 18-20).

Models 1 and 2

By mathematically manipulating Equation (14), Applicant demonstrates that when all other variables are maintained at the given values, decreasing fiber size results in increasing hydrohead <u>and</u>

decreasing Frazier (Model 1; Fig. 3); but that in order to maintain a constant Frazier when decreasing fiber size, the basis weight must be lowered (Model 2; Figs. 4 and 5). (As stated in Applicant's previous response, the "Fiber Diameter" column of Table 1 should have been replicated in Table 2. Applicant will amend Table 2 to include the Fiber Diameter column with the Examiner's indication that such an amendment would not constitute new matter).

The Problem and Solution

Beginning at page 13, Applicant explains that while Models 1 and 2 would seem to be the end of the discussion, a problem exists as to the ultimate strength of small diameter barrier layers when supporting a column of water, i.e. thin layers of nanofibers cannot adequately support enough pressure to achieve the maximum hydrohead mathematically described in Equation (5). In order to address this problem, the Applicant has discovered that supporting the nanofiber/barrier layer on a substrate having a particular pore size limit will avoid breakthrough of the barrier layer (page 13, line 20 through page 14, line 9). Equation (16) therein indicates the relationship between actual hydrohead, the fiber diameters of both the barrier and support layers, the tensile strength of the barrier layer fibers, the basis weight of the barrier layer and the solids fraction. Model 3 illustrates the deficiencies of low barrier layer strength, when the basis weight is reduced to maintain high Frazier. At page 14, lines 24-26, Applicant concludes:

> The maximum hydrohead could be realized by doubling the basis weight of the barrier layer, but doubling the basis weight would reduce the air permeability of the composite fabric by half...An alternative solution is to reduce the pore size of the support layer by reducing the support layer fiber size. (Emphasis added).

Applicant continues:

> The model relationships presented here permit the rational design of fabrics for various balances of barrier and air permeability. Clearly, the underlying physics allow only certain balances of properties to exist. Once a realizable balance is specified, choices can be made as to how to create a given balance.
>
> For example, since permeability depends upon the square of fiber diameter, choosing the largest fiber size consistent with achieving a desired barrier might be preferred as a means of achieving the highest permeability. Hydrohead can be increased by calendering the fabric to increase solids fraction (Equation 5). The dependence of hydrohead and Frazier on solids fractions is such that calendering the barrier layer to increase the solids fraction will increase barrier more than it decreases Frazier. If smaller fiber size is selected for barrier as the product basis, basis weight can be adjusted within bounds to achieve the desired air permeability. Other such tradeoffs can be assessed based on economics and the practicalities of fabric processing. (Page 15, lines 7-22; emphasis added).

The limitations of claims 1 and 14 provide a novel and non-obvious balance of air permeability and hydrostatic head in a nonwoven fabric which is a composite of a nanofiber barrier web and a suitable support web therefore.

Zucker

Zucker is directed to improvements only in barrier-to-basis weight ratio (paragraphs 0001 and 0017), but is silent as to air permeability. Zucker suggests combinations of nano-denier fabrics with "breathable" barrier films (microporous films) (paragraph 0028), which are discussed in the present specification as being too restrictive to air flow for long term wearer comfort. Zucker even discloses dusting a nano-denier fiber layer onto monolithic films (paragraph 0026), which combination would have no air flow permeability. Zucker never comments on the results of his proposed combination, i.e. what would be the result of adding a

nanodenier fibrous layer to a breathable barrier film? The skilled artisan is left to guess.

The Examiner suggests that the proposed Zucker composites would inherently have the presently claimed combinations of hydrohead and Frazier air permeability, since Zucker proposes a simple combination of a polyolefin nanofiber barrier layer bonded to a support layer. Likewise, the Examiner poses that the solids fraction value of claim 13 would be inherent to the Zucker disclosure. Applicant respectfully traverses the Examiner's findings on these inherency issues.

Applicant submits that the detailed discussion above (and in the specification as well as during the personal interview) reveals that neither hydrohead nor Frazier values can be considered inherent in the bare-bones description provided by Zucker. Zucker never even discloses preferred basis weights, let alone the complex combination of factors discussed in the present application, which result in the novel and nonobvious products set forth in claims 1 and 14 of the present application. Zucker's mere suggestion of "dusting" a layer of polyolefin nanofibers onto a scrim is insufficient to constitute anticipation or even obviousness of the present claims. Zucker's suggestion ignores the inverse relationship between hydrohead and Frazier created by increasing basis weights, and provides no insight as to the criticality of solids fraction of the nanofiber layer, nor how solids fraction can be modified, nor the significance of the pore size/fiber size of the underlying support layer. Suggestions that the skilled artisan might be able to derive from Zucker a combination of fabric layers which would fall within the scope of the present claims is not sufficient to establish inherency, as inherency must be certain.

> The fact that a certain result or characteristic <u>may</u> [optimally] occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. <u>In re Rijckaert</u>, 9 F.3d 1531, 1534; 28 USPQ2d 1955, 1957 (Fed. Cir. 1993); <u>In re Oelrich</u>, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). In relying upon the theory of inherency, the examiner must provide a

> basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. Ex parte Levy, 17 USPQ2d 1461, 1464 (BPAI 1990) (emphasis in original). **MPEP 2112**.

Applicant's discussion of the multiple, interrelated factors in designing a barrier fabric meeting the limits of claims 1 and 14, as well as the data set forth in the present application as to Examples 1-9 and Table 4 (pp. 20-21) and Examples 10 and 11 and Table 5 (pp. 21-22), demonstrate that not just any combination of a nanofiber layer and a support layer will be sufficient to meet the claim limitations of the present application.

> The *prima facie* case can be rebutted by evidence showing that the prior art products do not necessarily possess the characteristics of the claimed product. In re Best, 195 USPQ at 433.

Finally as to Zucker, the Examiner acknowledges that Zucker is deficient in failing to disclose particular basis weights, hydroheads and Frazier values, but asserts that such limitations would be readily obtainable through "routine experimentation with variables such as fiber size, basis weight and solids fraction" by those skilled in the art (Office Action, bottom of page 10, bridging to page 11). Applicant traverses the Examiner's finding.

In order to establish a *prima facie* case of obviousness, the patent law requires that the rejection meets a three part test.

> First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on the applicant's

disclosure. **MPEP § 2142**, citing In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); emphasis added.

Applicant submits the Examiner's determination that the limitations of the present claims would be met by "routine experimentation" from the prior art disclosure is merely an "obvious to try" standard of obviousness. The Examiner's proposition would require modification and/or selection of too many possible variables to constitute mere "optimization" or "routine experimentation". As stated above, in order to achieve the balance of properties claimed herein, it is necessary to consider (1) the polymer used to make the fibers of the barrier web, (2) the fiber diameters of the barrier web, (3) the basis weight of the barrier web, (4) the solids fraction of the barrier web, (5) the maximum pore size between fibers of the barrier web, (6) the fiber diameters of the support web, (7) the pore size between fibers of the support web, and (8) the ratio of the fiber diameters of the barrier web to those of the support web. There is nothing in the cited references which would lead the skilled artisan to even consider, let alone "optimize", so many possible variables in designing a composite web as claimed herein, so as to achieve the claimed balance of both hydrohead and Frazier air permeability, generally known in the art to be inversely proportional, with any expectation of success.

> [T]o have a reasonable expectation of success, one must be motivated to do more than merely to "vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful." Similarly, prior art fails to provide the requisite "reasonable expectation" of success where it teaches merely to pursue a "general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it." Medichem v. Rolabo, 437 F.3d 1157, 77 USPQ2d 1865 (Fed. Cir. 2006); (internal citations omitted, emphasis added).

Withdrawal of the rejections as to anticipation and obviousness is requested on these bases.

Rejection under 35 U.S.C. §103(a) over Zucker

Claims 12 stands rejected under 35 U.S.C. §103(a) as obvious over Zucker. Applicant traverses this basis for rejection and respectfully requests reconsideration and withdrawal thereof.

As stated above, Zucker is fatally defective as it does not inherently disclose the subject matter of the independent claims, and therefore cannot be deemed to make obvious the present claims. The Examiner's attention is further directed to the data in Table 5, Examples 12-19, which in all cases, meet the Frazier and hydrohead limitations of claim 1, and have bubblepoint pore sizes of no more than about 12 microns. Withdrawal of the rejection is requested on this basis.

Rejection under 35 U.S.C. §103(a) over Zucker in view of Fabbricante et al.

Claims 5 and 6 stand rejected under 35 U.S.C. §103(a) as obvious over Zucker in view of Fabbricante et al. Applicant traverses this basis for rejection and respectfully requests reconsideration and withdrawal thereof.

Applicant reiterates his arguments in traverse of the application of Zucker to the present claims, as set forth above.

At page 6 of the Office Action, the Examiner suggests that Fabbricante et al. would motivate the skilled artisan to utilize nanofiber layers having basis weights between 10 and 30 gsm in the Zucker fabrics. The Examiner notes that Fabbricante et al. disclose "that increasing the basis weight improves hydrostatic head". Applicant traverses the significance of the Examiner's finding.

As discussed during the personal interview, increasing basis weight only increases hydrostatic head to a point, by providing a more uniform fabric layer with fewer defects through which water can penetrate. Once a "defect-free" layer is achieved, further increases in basis weight cease to

further increase hydrohead, i.e. after a point, hydrohead levels off with further increases in basis weight.

More importantly, Fabbricante et al. fail to disclose the effect of increasing the basis weight of the barrier layer on Frazier air permeability, which Applicant has demonstrated decreases with increasing basis weight (Model 3, page 14, specifically lines 24-26). Accordingly, merely increasing basis weight as suggested by Fabbricante et al. would detrimentally affect the Frazier air permeability of the resulting Zucker fabric, and not inherently form a fabric within the scope of present claim 6(1).

Likewise, Models 1 and 2 (pp. 12-13 of the specification) demonstrate that while reducing fiber diameters is effective in increasing hydrohead, there is a commensurate adverse effect on Frazier air permeability. Thus, it is clear that the limitations of claim 5(1) would not necessarily/inherently follow from combining the disclosures of Fabbricante et al. and Zucker.

Withdrawal of the rejection is requested on this basis.

Rejection under 35 U.S.C. §103(a) over Zucker in view of Benson et al.

Claims 10 and 11 stand rejected under 35 U.S.C. §103(a) as obvious over Zucker in view of Benson et al. (U.S. Patent No. 6,746,517). Applicant traverses this basis for rejection and respectfully requests reconsideration and withdrawal thereof.

As clearly set forth above, Zucker fails to anticipate or make obvious the hydrohead and Frazier limitations of the presently claimed invention.

The Examiner relies on Benson et al. for its disclosure of coating fibers with a hydrophobic coating. However, nothing in Benson et al. would cure the underlying deficiencies of Zucker.

Therefore, Applicant submits that even in combination, Zucker and Benson et al. cannot be deemed to make obvious the present claims. Withdrawal of the rejection is requested on this basis.

Rejection under 35 U.S.C. §103(a) over Zucker in view of Healey

Claims 23 and 24 stand rejected under 35 U.S.C. §103(a) as obvious over Zucker in view of Healey (U.S. Patent No. 6,554,881). Applicant traverses this basis for rejection and respectfully request reconsideration and withdrawal thereof.

As clearly set forth above, Zucker fails to anticipate or make obvious the present claims.

While Healey discloses various fiber diameter ranges for spunbonded webs, nothing in Healey would suggest to the skilled artisan the complex relationship between nanofiber diameter, support fiber diameter, solids fraction and basis weight necessary to obtain the presently claimed nonwoven fabrics. As such, Healey cannot cure the underlying deficiencies of Zucker, and therefore, even in combination Zucker, cannot be deemed to make obvious the present claims. Withdrawal of the rejection is requested on this basis.

In view of the foregoing, allowance of the above-referenced application is respectfully requested.

Respectfully submitted,

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TWS:

Enclosures: Fig. 1 (modified)